10/520306

JT12 Rec'd PCT/PTO 05 JAN 2005

3/pot8

Shoe, adjustable, ~~transpiring and cushioning~~

Walking is known to require protection of the feet by some form of footwear such as shoes.

Shoes, however, practically enclose the foot in a chamber that retains perspiration and warmth.

It often follows that this condition provokes aching, overheating, unpleasant odours, inflammation.

To overcome these drawbacks soles have been devised complete with means providing ventilation between the foot and the shoe, or physical means, such as filtering membranes, or mechanical means.

Such means, however, cannot at present provide more ventilation per step than one cm^3 while at least 10 cm^3 per step would be needed.

Since the effort required to obtain this ventilation is made by the weight of the body as the pressing force and lowering of the sole as movement, it follows that the sole must be adequately lowered .

In hot climates and during the stresses set up by sports activity, much better ventilation is obviously required.

The above invention not only makes possible a far greater quantity of air transpired at each step, but also creates a cushioning effect as will now be explained.

Subject of the invention is an adjustable transpiring and cushioning shoe, the sole of which comprises an insole with through holes

forming the bottom of the shoe, a tread with one-way expulsion valves and an intermediate elastic structure containing a plurality of small chambers side by side each of which communicates, by means of a one-way valve here called a suction valve, with the inside of the shoe and by means of an expulsion valve with the outside.

When the foot presses the ground, causing said intermediate structure to yield by compression and flexion, at each step there is automatic closure of said suction valves, compression of the air contained in the chambers and its expulsion outside through the expulsion valves.

When the foot leaves the ground the expulsion valves automatically close and the suction valves automatically open thus transferring the air, mixed with perspiration and heat, from insideinside the shoe into the chambers through said suction valves connected to the holes in the insole.

The chambers are preferably obtained in their full height from the intermediate structure comprising an upper base, thin peripheral and internal ribs, glued onto the tread.

The suction valves are formed of fine tubes in a single piece with the intermediate structure, placed substantially alongside an inner wall of the ribs and open at the top at the position of the holes that pass through the insole.

Placed on the inside surface of the tread, in line with and at a short distance from each of said tubes, are raised cone-shaped protrusions the mean diameter of which corresponds to the inner diameter of said tubes, so that when the foot begins to apply pressure to the ground, and due to elastic flexion of the intermediate structure, the ends of said tubes, making contact with said protrusions, cause said suction valves to close.

In one execution the tubes that form the suction valves can be replaced by ducts made inside the ribs of the intermediate sructure.

According to the type of execution, the ribs on the intermediate structure can be inclined or curved to facilitate flexion under pressure from the foot.

The expulsion valves are preferably membranes with cross cuts the thickness of which is greater, and their height lesser, the greater is the force programmed for causing them to open.

According to the type of execution the membranes can be discoid, cone-shaped, cap-shaped.

Dimensions of the decisive parts of the sole, such as its height, the height of the intermediate elastic structure, rib thickness, volume of the chambers, dimensions and thicknesses of the suction and expulsion valves and therefore the volumes of transpiration air and forces needed to operate said valves, are all pre-set according to the type of shoe and therefore according to what is required to withstand stresses created during sports, military uses, ordinary walking, use by children, for high boots, for orthopaedic purposes.

The invention offers evident advantages.

The quantity of heated air mixed with perspiration removed from the shoe by suction at each step, that can be estimated at between 10 and 350 cm^3 , is considerably more than is needed to eliminate the amount of heat and perspiration that forms inside a shoe even under highly stressed conditions.

Elimination of heat from the feet keeps them cool while elimination of perspiration keeps them dry.

By suitably calculating the dimensions of the decisive parts of the sole, a cushioning effect can also be calculated.

In conclusion, deambulation, both in highly stressed conditions of effort and heat as well as in ordinary walking, can be undertaken with greatly increased comfort by the wearer of these shoes.

Characteristics and purposes of the invention will be made still clearer by the following examples of its execution illustrated by diagrammatically drawn figures.

Fig. 1 The invented shoe, the sole of which comprises an insole, a tread and an intermediate structure, of considerable thickness to withstand stresses, side view.

Fig. 2 Longitudinal section of the sole, through the axis XX.

Fig. 3 Enlarged detail of Figure 2.

Fig. 4 Detail of Figure 3 seen from below.

Fig. 5 Insole, perspective seen from below.

Fig. 6 Intermediate structure, perspective seen from below.

Fig. 7 Tread, perspective seen from below.

Fig. 8 Walking shoe with thinner sole, side view.

Fig. 9 Enlarged longitudinal section of the shoe sole in Figure 8.

Fig. 10 The detail in Figure 9 seen from below.

The shoe 10 made to withstand high stresses (Figure 1) presents an upper 11 and a sole 15 consisting of the insole 20, tread 40 and elastic structure 25.

Said structure 25 comprises the peripheral ribs 30, a network of transversal ribs 31, valve bodies 32 with cylindrical holes 33 and the small chambers 38 formed by said ribs, open towards the tread 40.

The tread 40 comprises externally the transversal channels 41 and, between one channel and another, the cylindrical holes 45 situated substantially in the centre of the chambers 38 of the membrane 30.

Said holes 45 are closed by the conical expulsion valves with membrane 50, with the top 51 facing towards the outside of the tread, and with cross cuts 52 and 53.

As the cuts are made in elastic material on the inside of the cone, the edges of the cut close hermetically when external pressure is greater than pressure from inside the shoe.

Inside the tread 40 are the valve heads 34 of the valve bodies 32 in the intermediate structure 25.

Said valve heads 34 are cone-shaped and are placed in line with said valve bodies 32, together forming the suction valves 35.

The insole 20 presents, in line with the valve bodies 32, holes 21 diameter of which is the same as that of said valve bodies 32.

The holes 21 in the insole 20 and the holes 33 in the valve bodies 32 and in the valve heads 34 present the same geometrical axis (shown as AA in Figures 2 and 3).

This axis lies substantially in the centre of each transversal channel 41 of the tread 40.

The holes 45 in the tread for conical membrane expulsion valves 50, crossed by axes BB in Figures 2 and 3, are situated substantially in the centre of the chambers 38 in the intermediate structure 25 and therefore between one channel 41 and another.

Both the intermediate structure 25 and the tread 40 are respectively made in a single piece of suitably elastic plastic material.

It will be clear from the foregoing that when, during deambulation, the shoe 10 worn by the person rests on the ground, this will cause compression and deformation of the ribs 30 and 31 and also of the valve bodies 32.

Matching between the ends of the valve bodies 32 and valve heads 34, and therfore closure of the valves 35 formed by these parts, consequently causes the air 6 in the chambers 38 to flow out through the cone-shaped valves 50 in the tread 40 (Figure 3).

When the foot leaves the ground, the ribs 30 and 31, the valve bodies 33 and the cone-shaped valves 50 tend to resume their original shape, namely opening of the valves 35 and closure of the valves 50, so creating a depression inside the chambers 38, and therefore suction through the valve bodies 33 and holes 21 in the insole 20, of heated air containing perspiration from inside the shoe 10.

It follows that, at each step, there will be high degree of ventilation from the shoes with a flow of air far greater than can be obtained with present footwear, as well as an efficacious cushioning effect.

The ventilating and cushioning effect can be adjusted by applying suitable dimensions to the chambers, to the intermediate structure 25, to thickness of the peripheral ribs and those inside the valves 35 and 50, and therefore volume and capacity of ventilating air.

Figure 8 shows a walking shoe 60 with an upper 61 and sole 65.

The sole 65 is substantially the same as the sole 15 for the shoe 10 but dimensions are smaller.

Said sole 65 presents an insole 70, intermediate structure 75 and tread 85.

The insole 70 presents holes 71.

The intermediate structure 75 presents ribs 76, chambers 80 and valve bodies 77 with cylindrical holes 78.

The tread 85 presents cone-shaped membrane valves 90 for expulsion with orthogonal cuts 92, 93 in the holes 86.

Said valves are thinner 95 and higher 96 than the membrane valves 50 in the tread 40 of the shoe 10.

As said valves 90 in the shoe 60 open at the slightest pressure into the chambers 80, these are of the type best suited for ordinary walking, for children, for rubber boots and the like.